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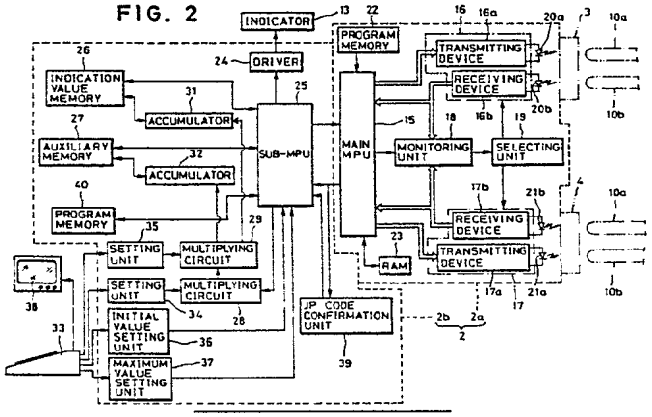
(54) Controlling apparatus for games machines.

(57) In a control system where a master control unit controls a game machine, the master control unit is provided with two calculating means and a microprocessor. The two calculating means accumulate, at different rates, values each corresponding to the number of coins inserted into each of the game machines for every game. The two accumulated values are used alternately as an amount of money to be paid out for a particular hit and one of the values is indicated by an indicator. For every occurrence of the hit, the microprocessor orders that coins are to be paid out according to the indicated value and that the indicated value is alternately changed from one of the two accumulated values to the other.

FIG. 2



CONTROLLING APPARATUS FOR GAMES MACHINES

The present invention relates to a controlling apparatus for games machines, and more particularly to a controlling apparatus for coin-operated games machines such as slot machines into which coins or tokens (which are both hereinafter referred to as "coins" for simplicity) are inserted for playing a game.

There are a large number of coin-operated games machines sited in casinos or game centres which are organised under a control system whereby the game machines are divided into some groups in each of which a special favour is enjoyed when a specific win is accomplished. For example, slot machines are divided into groups each of which has about 20 to 30 slot machines and particular hits or wins such as jack-pots (a jack-pot is the largest hit of a slot machine game and is hereinafter referred to as a "JP") are processed for each group by a so-called progressive method.

In this progressive JP-process, a master control unit controls a plurality of slot machines, for example, 30 slot machines as one group and accumulates a predetermined percentage of an amount of money corresponding to the number of coins inserted into each slot machine of the group. When a JP occurs in one of the slot machines, the master control unit orders the slot machine to pay out coins corresponding to the accumulated money. An indicator shows the amount of money accumulated to be paid out, so players can enjoy playing the machine with expectation of hitting a JP which brings an enormous amount of money increasing as time passes.

In a conventional JP progressive method, the money accumulated by the master control unit is cleared to zero and the indicator correspondingly indicates zero after one JP occurs. Therefore, the players are disappointed, losing their interest in hitting a JP.

To settle this problem, in another progressive JP-progress, a minimum amount of money is set up and the accumulation starts from the minimum amount of money. A player hitting a JP can receive prize money more than the minimum amount of money even when a second JP occurs soon after another JP. However, the minimum amount of money can not be set too high, because of the required pay-out ration. Accordingly, the amount of money for a JP which occurs soon after the last JP is substantially small.

It is therefore an object of the present invention to provide a controlling apparatus for game machines, by which expectation of making a particular hit is not lost even just after an occurrence of the particular win.

According to the present invention, there is provided an apparatus for controlling a plurality of game machines each of which has pay-out means for paying out coins according to the kind of prizes or hits of games, said apparatus being provided with means for indicating a pay-out value for a particular prize or hit, and said apparatus comprising:

first calculating means for calculating a first accumulation value by accumulating a first value which is an insertion value of coins at a first rate, said insertion value corresponding to the number of coins inserted into each of said game machines;

second calculating means for calculating a second accumulation value by accumulating a second value which is said insertion value at a second rate; and

controlling means for ordering said indicating means to indicate one of said first and second accumulation values as said pay-out value, for ordering said pay-out means of a said game machine in which said particular prize or hit occurs to pay out coins of which number corresponds to said pay-out value, and for ordering said indicating means to indicate the other of said first and second accumulated values as said pay-out value after said particular prize or hit occurs.

In a preferred embodiment of the present invention, the controlling apparatus further comprises a setting means for setting an initial value in the calculation means which has stored the accumulation value used as the pay-out value, after occurrence of the particular winning.

According to an optional feature of the present invention, as the pay-out value which is being accumulated and increasing in its magnitude is indicated, players can start or continue the game, having great expectation of obtaining a large amount of money, even just after the particular hit takes place.

According to another optional feature of the present invention, if a particular winning occurs just after the former occurrence of the particular winning, large number of coins appropriate to the particular hit can be paid out for the hit because of setting of an initial value.

The invention will be further described by way of non-limitative example with reference to the following description, taken in connection with the accompanying drawing in which:

Figure 1 is a schematic view showing a control system in which a master control unit embodying the present invention is used for controlling slot machines;

Figure 2 is a block diagram showing the master control unit of figure 1;

Figure 3 is a block diagram showing a slave unit in one slot machines of figure 1;

Figure 4 is a time chart explaining the sending and receiving of messages between one of the slave units and a corresponding one of the machine control units of figure 1;

Figure 5 is a time chart explaining the sending and receiving of messages between the master control unit and one of the slot machine control units of the control system of figure 1 through a corresponding slave unit;

Figure 6 is an illustration explaining the basic format of a message used for communication performed by the control system of figure 1;

Figure 7 shows a command code table, the command codes being included in messages for the communication;

Figure 8 is an illustration explaining schematically a data request message used for the communication;

Figure 9 is an illustration explaining a coin data message used for communication;

Figure 10 is a time chart explaining operation of switching of communication units provided in the master control unit of figure 2;

Figure 11 is an illustration explaining a JP occurrence message used for communication; and

Figure 12 is an illustration explaining a JP data message used for communication.

Referring now to the drawings, like reference characters designate like or corresponding parts throughout the twelve views. Figure 1 shows a controlling system which operates in a progressive method for a particular hit such as JP. A master control unit 2 is provided with a pair of first and second connectors 3 and 4 having quite the same construction. Provided in a plurality of slot machines 5a, 5b, 5c, ..., 5x, 5y and 5z making-up one group are a plurality of respective slave units 6a, 6b, 6c, ..., 6x, 6y and 6z, each having a pair of first and second connectors 7 and 8. The master control unit 2 intercommunicates with each of the slot machines 5a to 5z in the group through the slave units 6a to 6z by exchanging messages which includes data and commands relating operations of the slot machines 5a to 5z.

The first connector 3 of the master control unit 2 is connected with the first connector 7 of the slave unit 6a through communication lines 10 comprising a transmitting cable 10a and a receiving cable 10b. The second connector 8 of the slave unit 6a is connected with the first connector 7 of the next slave unit 6b through the communication lines 10. By repeating such connection with the communication lines 10, all of the slave units 6a to 6z are connected in series. The second connector 8 of the last slave 6z is connected with the second connector 4 of the master control unit 2 through the communication line 10. After all these connections have been made, the master control unit 2 and the slave unit 6a to 6z form a looped communication circuit. Each of the slot machines 5a to 5z incorporates a respective slot machine control unit 11a, 11b, 11c, ..., 11x, 11y and 11z each incorporating a microprocessor for controlling their individual operation of the respective slot machines 5a to 5z. Each of the slave units 6a to 6z exchanges messages including data and commands with the corresponding one of the slot machine control units 11a to 11z. There is provided an indicator 13 which is connected to the master control unit 2 so as to indicate the amount of money to be paid out for the JP. This indicator 13 is provided in a place where the indicator 13 can be observed by all players playing the slot machine 5a to 5z in the group.

As shown in figure 2, the master control unit 2 comprises a communication block 2a and a JP-process block 2b. The communication block 2a is provided with the first and second connectors 3 and 4, a main microprocessor unit (which is hereinafter referred to as a "main MPU") 15, first and second communication units 16 and 17, a monitoring unit 18, a selecting unit 19, a program memory (ROM) 22, and a RAM 23. The first and second communication units 16 and 17 have the same structure and function and they send messages to the slave units 6a to 6z and receive messages therefrom. The first communication unit 16 faces the first connector 3 and is provided with a transmitting device 16a and a receiving device 16b. The second communication unit 17 faces the second connector 4 and is provided with a transmitting device 17a and a receiving device 17b. The monitoring unit 18 monitors the state of the communication by checking the outputs of the receiving devices 16b and 17b of the first and second communication units 16 and 17 and outputs signals representing the state of the communication. According to the outputs of the monitoring unit 18, the selecting unit 19 selects one of the first and second communication units 16 and 17 and renders it operative. Therefore, communication with the slave units 6a to 6z is carried out by using only one of the communication units 16 and 17.

In this embodiment, for optical communication, the transmitting devices 16a and 17a have light-emitting diodes 20a and 21a, and the receiving devices 16b and 17b have photo diodes 20b and 21b. It is to be noted that, as described before, only one of the communication units 16 and 17 is electrically actuated by the selecting unit 19. The transmitting and receiving cables 10a and 10b are made of optical fibre cables. The ends of these

cables 10a and 10b are connected to or held in the connectors 3 and 4, which position the end faces of the cables 10a and 10b so as to face the light emitting diodes 20a and 21a and the photo diodes 20b and 21b.

According to programs for communication, stored in the ROM 22, the communication units 16 and 17 and the monitoring unit 18 are operated in predetermined sequences and the RAM 23 stores the data in the received messages from the slave units 6a to 6z and a history of each slot machine 5a to 5z.

The JP-process block 26 has a sub-microprocessor unit (which is hereinafter referred to as a "sub-MPU") 25, two multiplying circuits 28 and 29, two accumulator 31 and 32, an indication value memory 26, an auxiliary memory 27, two setting units 34 and 35, an initial value setting unit 36, a maximum value setting unit 37, a driver 24, a JP code conformation circuit 39, and a program memory 40. The sub-MPU 25 controls operations in the JP-process block 2b according to sequences stored in the program memory (ROM) 40 and processes data relating the number of coins inserted in each of the slot machines 5a to 5z. First, a data of a value "M" representing an amount of money corresponding to the number of inserted coins is sent from the main MPU 15 to the multiplying circuit 28 so as to be used for obtaining a data of a value "T" which is obtained from multiplying the value "M" by constant "t" (total rate) less then "1". Then, the data of the value "T" is sent to the multiplying circuit 29 and used for computing two values "J" and "K". The values "J" and "K" are obtained by the following calculations:

$J = T \times (1-x)/100$

$K = T \times x/100$

where x is a storage rate. The storage rate "x" is entered via a keyboard 33 and is stored in the setting unit 35 and the total rate "t" is also entered with the keyboard 33 and is stored in the setting unit 34. The "J" data value is further sent to the accumulator 31 to obtain a value "I" which is calculated by accumulation of the value "J". That is, the value "J" is added to a value "I_o" read out from the indication value memory 26 and then the content of the indication value memory 26 is updated by writing the added value "I". The obtained value "I" is stored in the indication value memory 26 and indicated by the indicator 13. As well as the value "J", the "K" data value is further sent to the accumulator 32 and a value "S" is calculated by accumulating the value "K".

Suppose that 0.01 (1%) is set as the total rate "t", 0.4 (40%) is set as the storage rate "x", and three coins of $1 are inserted into one of the slot machines 5a to 5z for playing one slot game. According to multiplication and accumulation as described above, the value "J" ($J = 0.01 \times 0.6 \times 3$) is "¢1.8", and the value "K" ($K = 0.01 \times 0.4 \times 3$) is ¢1.2. These values "J" and "K" are accumulated in the accumulators 31 and 32 and stored in the indication value memory 26 and the auxiliary memory 27 respectively. If the amount of money to be indicated and paid out has a fraction, the fraction is rounded down, or the fraction may be rounded up or off.

The initial value setting unit 36 is provided for setting a predetermined initial value "S_o" with the keyboard 33. After coins are paid out for a JP according to the value I stored in the indication value memory 26, the data in the indication value memory 26 is cleared to zero and then the value S stored in the auxiliary memory 27 is transferred to the indication value memory 26. The auxiliary memory 27, after being reset, stores the initial value "S_o". The initial value "S_o" is previously determined based on the JP occurrence probability and pay-out ratio. Accumulation of the value "K" starts from the value "S_o" and then accumulation of the value "J" is performed after transfer to the indication memory 26. Hence, the initial value "S_o" need not be so large.

The maximum value setting unit 37 is provided for setting a maximum value "IS_{max}" and can be variable set through the keyboard 33. A monitor 38 displays the values "t", "x", "S_o" and "IS_{max}" for easy grasp of the JP-process by the players. The JP code confirmation unit 39 confirms whether a message sent from the main MPU 15 is a JP occurrence message or not. The program memory 40 stores above described sequences performed by the sub-MPU 25.

Figure 3 shows the schematic diagram of the slave unit 6a which is the same as the other slave units 6b to 6z. Therefore, the explanation for the slave units 6a to 6z will be given only for the slave unit 6a. The slave unit 6a comprises a microprocessor unit (which is hereinafter referred to as a "slave MPU") 45, a first communication unit 46 having a first receiving device 46a and a first transmitting device 46b, a second communication unit 47 having a second receiving device 47a and a second transmitting device 47b, an address setting unit 48 for allocating an address to the slave unit 6a, a ROM 49, a RAM 50, and a message checking unit 51. The ROM 49 stores a sequential-processing program for the slave unit 6a, according to which the slave MPU 45 will operate. In the message checking unit 51, messages from the slot machine control unit 11a are checked as to whether or not the message meets a predetermined format. This slot machine control unit 11a controls the sequence and the processes of the games of the slot machine 5a and outputs data such as the number of inserted coins to the slave unit 6a for

JP-process by the progressive method described later. Further, when a hit occurs in the slot machine 5a, the slot machine control unit 11a pays out coins according to the kind of hit, driving a well-known hopper 55.

The first and second receiving devices 46a and 47b have photo diodes 52a and 53b respectively for receiving message signals, and the first and second transmitting device 46b and 47a have light-emitting diodes 52b and 53a for transmitting message signals. The photo diodes 52a and 53b and the light-emitting diodes 52b and 53a are the same in specification as those used for the receiving and transmitting devices 16a, 16b, 17a and 17b in the master control unit 2 which performs optical communication.

Each of the slot machine control units 11a to 11z controls the associated slot machine with respect to the following, in the order of operation sequence of the slot machine for a game:
- detection of insertion of coins;
- measurement of the number of inserted coins;
- detection of pulling of the slot machine start lever;
- operation of the starting and stopping of the slot machine reels;
- decision as to whether the game is to be a hit or not and of the kind of hit when the game is to be a hit; and
- operation of pay-out coins according to the kind of the hit when the game is a hit.

When coins are inserted for a game, the slot machine control unit generates and sends a coin data message to the slave unit. The coin data message comprises a series of several bytes including a start code for the first byte of 8 bits, a coin data code for intermediate bytes, and an end code for the last byte. The coin data message depends on the number of inserted coins.

The operation of this embodiment will not be described in detail. Referring to figure 3, the coin data message is sent to the message checking unit 51 of the slave unit 6a from the slot machine control unit 11a so as to be checked in format; and only when the coin data message is correct as to format does the slave MPU 45 store the data in the RAM 50. When the coin data message is judged to be incorrect as to format, the slave MPU 45 refuses to receive the coin data, and then the coin data is not stored in the RAM 50.

Figure 4 shows an example of message communication between the slave unit 6a and the corresponding slot machine control unit 11a. Only communication with respect to the slave unit 6a is explained because the communications with respect to the other slave units 6b to 6z are the same as that of the slave unit 6a. Upon correctly receiving a coin data message from the slot machine control unit 11a, the slave unit 6a sends a reception-correct message to the slot machine control unit 11a. But upon incorrectly receiving a coin data message from the slot machine control unit 11, the slave unit 6a sends a reception-error message to the slot machine control unit 11a. In this case, the slot machine control unit 11a again sends the same coin data message to the slave unit 6a. Furthermore, when no reception-correct message is sent to the slot machine control unit 11a from the slave unit 6a for a predetermined time Δt_x, the slot machine control unit 11a also sends the coin data message again. Such communication also takes place between each of other slave units 6b to 6z and the corresponding one of the slot machine control units 11b to 11z, and the data as to the number of the inserted coins is stored in each of RAMs 50.

The communication between the slave unit 6a and the communication block 2a of the master control 2 is illustrated by the time chart of figure 5. A message including data and commands is generally constructed according to the basic format shown in figure 6. The message consists of serial codes, namely a start code (STX), an address code (ADR), a command code (CMD), a text (TXT), a check sum (CHS), and an end code (EXT), each of which is represented by a combination of binary digits "1" or "0". Each code consists of 8 bits except for the text (TXT).

A command code table is shown in figure 7 in which the upper four digits are arranged in a row and the lower digits are arranged in a column. According to this table, the start code is represented by "02" in hexadecimal notation, eg, "&H02", the end code is "&H03", the data request command is "&H20", and the coin data code is "&H30". The check sum (CHS) is obtained, first by performing an exclusive OR operation in which each digit from the start code (STX) to the text (TXT) for each digit of the lower seven bits is added (eliminating their carries), and secondly by setting the most significant bit (MSB) "1". The check sum (CHS) obtained in this way is used, as is well known, to mae sure that the message includes no data errors.

The communication block 2a periodically sends data request messages of a constant duration to the slave unit 6a according to a sequence program stored in the program memory 22. The structure of the data request message is schematically shown in figure 8. In figure 8, also the actual serial binary signals corresponding to the data of the data request message are shown. For example, at the time corresponding to the binary signal "1", the light-emitting diode 20a will turn on. Therefore, the data request message as well as other messages is transmitted to the photo diode 52a of the slave unit 6a in a form of a series of on-and-off light

signals through the transmitting cable 10a.

As shown in figure 8, when the address code in the data request message is "&H35", the address code "&H35" specifies a slave unit having an address "5". When the slave unit 6a has an address "5", the slave unit 6a receives the data request message and in reply sends the coin data message including the number of the inserted coins to the communication block 2a through the first transmitting device 46b. The number of the inserted coins is read out from the RAM 50.

After the master control unit 2 has received the coin data message, the master control unit 2 sends a coin data confirmation message to the slave unit 6a to confirm whether the number is true or not. Then, the slave unit 6a collates the number of the inserted coins in the coin data confirmation message with the number of the inserted coins stored in the RAM 50. When the numbers coincide, the slave unit 6a sends a reception-correct message to the master control unit 2 and simultaneously clears the data in the RAM 50. If the numbers do not coincide, a reception-error message is sent from the slave unit 6a to the master control unit 2, and again the same data request message is sent to the slave unit 6a.

The slave unit 6a transfers the data request message, from the master control unit 2 to the next slave unit 6b, through the transmitting device 47a. Similarly, the next slave unit 6b also transfers the data request message to the slave unit 6c. In this way, the data request message is transferred by all the slave units and finally reaches the communication unit 17 of the communication block 2a, having fully traversed the looped communication circuit. By operating the receiving device 17b of the second communication unit 17 while the first communication unit 16 is effective, the transmitting state of at least the communication cable 10a may be monitored by checking the outputs of the receiving device 17b by the monitoring unit 18.

A coin data message is schematically illustrated in figure 9, in which, following a command code having a code "&H30" indicating that this message is a coin data message, a text having codes "&H31" and "&H35" is shown. These data "&H31" and "&H35" mean that the number of coins inserted into the slot machine 5a is fifteen. The coin data message, as described above, is comprised by a series of on-and-off light signals from the light-emitting diode 52b in the transmitting device 46b, to be sent to the photo diode 20b of the communication block 2a through the communication cable 10b.

When the data as to the number of inserted coins is, in this way, sent from the slave unit 6a having the address "5", the data is stored in the RAM 23 of the communication block 2a. After converting the data read out from the RAM 23 to the value of amount of money corresponding to the number of inserted coins, the main-MPU 15 sends the value to the JP-process block 2b. In the JP-process block 2b, the value is computed with the multiplying circuits 28 and 298 successively, and accumulated by the accumulator 31 and 32 by two different rates, as described before. The two differently-accumulated values "I" and "S" are stored in the indication value memory 26 and the auxiliary memory 27 separately.

Suppose that the total rate "t" is set 0.01 (1%), the storage rate "x" is set 0.4 (40%), and the amount of money "M" corresponding to the number of the inserted coins is 3 ($3). According to the calculations, the value "J" is ¢1.8 and the value "K" is ¢1.24. The value "J" is accumulated to the value "I" stored in the indication value memory 26. The value "K" is accumulated to the value "S" stored in the auxiliary memory 27.

For collection, calculation and storing as to the coin data of other slot machines 5b to 5z, the communication block 2a sends the data request messages successively to the slave units 6b to 6z, varying the address code. Therefore, the communication block 2a can obtain the coin data with respect to the number of coins inserted into each of the slot machines 5a to 5z. Based on every message, the values "I" and "S" in the indication and auxiliary memories 26 and 27 are updated.

Figure 10 shows automatic detection of the communication being partially interrupted due to disconnection of the communication line 10, for example, between the slave units 6w and 6x. The data request messages for the slave units 6x, 6y and 6z cannot reach each slave units 6x to 6z by use of the first communication unit 16. When the monitoring unit 18 detects that no coin data message from the slave unit 6x has been received for a pre-fixed time Δt_y because the slave unit 6a cannot receive a data request message, the selecting unit 19 renders the second communication unit 17 operative in lieu of the first communication unit 16. Then, the same data request messages are transmitted out through the transmitting device 17b in the reverse direction in the looped communication circuit, reaching the slave unit 6x. The slave unit 6x sends its coin data message in response, from the second communication unit 47 to the second communication unit 17 of the communication unit 2a. And thereafter other slave units 6y and 6z which cannot receive the data request messages by use of the first communication unit 16 can also successively receive the data request message and send their coin data messages by the second communication unit 17. For the next cycle of communication with the slave units 6a to 6w, the first communication unit 16 is again rendered operative. Then,

for message exchange with the slave units 6x to 6z, the second communication unit 17 is made effective alternatively by monitoring unit 18 and selecting unit 19. In this way, even if a cable disconnection occurs in this system, the communication unit 2a can obtain messages from all of the slave units 6a to 6z by alternatively using either of the first and second communication units 16 and 17 to continue the communication without interruption.

The time period Δt_y is set to be a little longer than the period from the time when the data request message is fed from the master control unit 2 until the time when the response message from a corresponding slave unit reaches the master control unit 2. An indicator may be provided to indicate which communication cable is disconnected. After reconnection of this communication cable again the intercommunication by means of only the first communication unit 16 can resume.

Until the next JP occurs in any of the slot machines 5a to 5z, part (0.6% = 0.01 x 0.6) of the amount of money corresponding to the number of the inserted coins is accumulated in the indication memory 26 and another part (0.4%) is accumulated in the auxiliary memory 27 for every coin insertion. The value "I" stored in the indication value memory 26 is indicated by the indicator 13 through the driver 24, letting players of the slot machines know the amount of money to be paid out for a JP when it occurs in the group of the slot machines 5a to 5z. It should be noted that only one or predetermined denominations of coin, for example $1 coins, can be inserted in each of slot machines belonging to one group. Therefore coins of different denominations are rejected.

Because usually the probability of occurrence of JP is set to be extremely small, the values "I" and "S" often increase to very large figures. Viewing the indicated vast amount of money, the players can enjoy the slot game with great expectations of a chance of getting the money. Because of setting of the maximum value "IS_{max}" for the values "I" and "S", the amount of money to be paid out for a JP cannot exceeds the maximum value "IS_{max}", for example, $5,000. After the indicated value reaches the "IS_{max}" , the indicator 13 continues to indicate the "IS_{max}" and the accumulation of the values "I" and "S" stops until the next JP occurrence.

Next, a sequence of message exchange between the master control unit 2 and one of the slot machine control units 6a to 6z will be explained for when a JP occurs in the corresponding slot machine. If a JP takes place, for example, in the slot machine 5a, a message having data representing the occurrence of a JP is sent from the slot machine control unit 11a to the slave unit 6a as shown in figure 5, in order to store the data in the RAM 50. When a data request message for the slave unit 6a is sent from the master control unit 2, the slave unit 6a sends a JP occurrence message, whose schematic structure is illustrated in figure 11. In the command code (CMD) and text (TXT) of this JP occurrence message, the JP code "&H31" representing the JP occurrence is contained commonly.

The communication block 2a of the master control unit 2 receives the JP occurrence message and collates the JP code of the message with a JP code stored in the JP code confirmation unit 19. When the two codes coincide, the communication block 2a orders the sub-MPU 25 in the JP-process block 2b to start JP process.

For the JP process, first, the value I stored in the indication value memory 26 is transferred to the main MPU 15 through the sub-MPU 25. The main MPU 15 sends a JP data message to the corresponding slave unit 6a. An example of the JP data message is shown in figure 12, in which the command code (CMD) "&H21" represents that this message is a JP data message and the text (TXT) "2550" represents that the amount of money is $2,550.00. The number of digits of the text (TXT) is set according to the number of digits of the amount of money to be paid out for a JP.

When this JP data message is supplied to the slot machine control unit 11a through the corresponding slave unit 6a, the slot machine control unit 11a stores the data as to the amount of money to be paid out and sends to the main MPU 15 a JP data confirmation message for confirming that the data is correctly received. This message includes a command code (CMD) "&H33" representing a JP response and a text (TXT) representing the value "I" which has been received by the slot machine control unit 11a.

The communication unit 2a orders the sub-MPU 25 to judge whether the text code in this JP data confirmation message is valid or not by comparing with the data of the value "I". When the code is valid, a JP occurrence confirmation message is fed to the slot machine control unit 11a through the slave unit 6a. Then, the slot machine control unit 11a reconfirms that the JP has surely occurred in this slot machine 5a and sends a JP confirmation response message to the master control unit 2 so that the master control unit 2 makes a final confirmation of the occurrence of a JP in the slot machine 5a.

After the final confirmation, the master control unit 2 sends a JP pay-out message to the slave unit 6a, which instructs the slot machine control unit 11a to pay out coins. Upon reception of the JP pay-out message, a hopper 55 operates to pay out coins under control of the slot machine control unit

11a, according to the value "I" as specified in the JP data message. The number of coins to be paid out is calculated according to the value "I" in the slot machine control unit 11a.

After the actual pay-out of the coins by the hopper 55, the slot machine control unit 11a sends a JP data reset message to the master control unit 2 through the slave control unit 6a. This JP data reset message includes a command code "&H34" representing reset of the value "I". After receiving the JP data reset message, the communication unit 2a sends by way of confirmation, a JP reset confirmation message to the slot machine control unit 11a through the slave unit 6a and then, the slot machine control unit 11a sends a JP reset response message to the master control unit 2. When the master control unit 2 has received the JP reset response message, the main MPU 15 sends a JP pay-out end message to the sub-MPU 25.

When the sub-MPU 25 receives the JP pay-out end message, the sub-MPU 25 clears the data of the indication value memory 26 and then transfers the value "S" in the auxiliary memory 27 to the indication value memory 26. Thereafter the sub-MPU 25 clears the data of the auxiliary memory 27 and then transfers the initial value "S_o", for example "1000", in the initial value setting unit 36 to the auxiliary memory 27, completing the whole of the JP-process.

There are many kinds of hit other than the JP and as is well known to those who are skilled in the art, for these hits, each slot machine control unit identifies the kind of each hit and orders the slot machine to pay out coins according to the identified kind.

According to the JP-process described above, even if one JP occurs immediately after another, the amount of money to be paid out is not so small for the largest hits because the value "I" for the JP starts from the value "S_o" which is transferred to the indication value memory 26. Therefore, the player can start or continue slot machine games without reducing their pleasure.

In the above embodiment, at the beginning of the operation of the system, the indication value memory 26 is set "O", the auxiliary memory 27 is set "1000" transferred from the initial value setting unit 36, and the indicator indicates "$0". A false JP pay-out end message may be fed to the sub-MPU 25 so as to set the initial value "1000" in the indication value memory 26 as the value "I". The constants "t", "x" and "S_o" can be manually changed through the keyboard 33 at any time.

When the storage rate "x" is set larger than 0.5, the rate of increase of the value "S" is greater than that of the value "I" and accordingly the amount of money to be paid out for a JP is greater than that for the former JP, thereby stirring up speculative interest of the players.

Though the functions of the indication value memory 26 and the auxiliary memory 27 differ from each other in the embodiment, these memories 26 and 27 may be used equally for the indication and the pay-out. That is, after an occurrence of a JP, the initial value "S_o" is set in the indication value memory 2b. The value "S" in the auxiliary memory 27 is used as the pay-out value for the next JP and is indicated by the indicator 13. When the memories 26 and 27 are thus used alternatively, the storage rate "x" is preferably set 0.5.

There is another method of determining the amount of money to be paid out for a JP, other than the method as in the above embodiment, that is, the greatest value among the values "I", "S" and "S_o" may be used by comparison.

The indicator 13 in the embodiment is placed at a place where all players of the slot machines belonging to one group can view the indicator 13. Instead of the indicator 13, each slot machine may be provided with an indicator for indicating the amount of money to be paid out for a JP, or indicating the number of coins to be actually paid out because the denomination is predetermined for each group of the slot machines.

Though a hopper is used in each slot machine as pay-out means in the embodiment, a well known credit device may be provided in combination with the hopper. In slot machines with the credit device, coins are not actually paid out for each hit but the number of coins to be paid out is accumulated by a credit counter and the accumulated number of coins is displayed by a credit display of the credit device. Before a game starts, the number in the credit counter decreases by a predetermined value necessary for one game. A player can play game without insertion of coins until the number in the counter becomes "0". When the player discontinues the game though the number is not "0", an adjustment button of the credit device is operated and then coins whose number corresponds to the number in the credit counter are paid out with the hopper.

Obviously many other modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the claims the invention may be practiced otherwise than as specifically described.

Claims

1. An apparatus for controlling a plurality of game machines each of which has pay-out means for paying out coins according to the kind of prizes or hits of games, said apparatus being provided

with means for indicating a pay-out value for a particular prize or hit, and said apparatus comprising:

first calculating means for calculating a first accumulation value by accumulating a first value which is an insertion value of coins at a first rate, said insertion value corresponding to the number of coins inserted into each of said game machines;

second calculating means for calculating a second accumulation value by accumulating a second value which is said insertion value at a second rate; and

controlling means for ordering said indicating means to indicate one of said first and second accumulation values as said pay-out value, for ordering said pay-out means of a said game machine in which said particular prize or hit occurs to pay out coins of which number corresponds to said pay-out value, and for ordering said indicating means to indicate the other of said first and second accumulated values as said pay-out value after said particular prize or hit occurs.

2. An apparatus as claimed in claim 1, further comprising first setting means for setting an initial value of said accumulation values, said initial value being inputted into one of said first and second calculating means of which accumulation value having been used as said pay-out value.

3. An apparatus as claimed in claim 2, further comprising second setting means for setting a maximum value for said pay-out value.

4. An apparatus as claimed in claim 3, further comprising third setting means for setting said first and second rates.

5. An apparatus as claimed in claim 4, wherein said third setting means comprises total rate setting means for setting a total rate so as to obtain a total insertion value which is multiplied by said insertion value and distribution rate setting means for setting a distribution rate by which said total insertion value is divided into said first and second rates.

6. An apparatus as claimed in claim 5, wherein said first and second accumulation values represent amount of money.

7. An apparatus as claimed in claim 5, wherein said first and second accumulation values represent number of coins.

8. An apparatus as claimed in claim 6 or 7, wherein said first calculating means comprises a first accumulator for obtaining said first accumulation value and a first memory for storing said first accumulation value, and said second calculating means comprises a second accumulator for obtaining said second accumulation value and a second memory for storing said second accumulation value.

9. An apparatus as claimed in claim 8, wherein said first accumulation value stored in said first memory is used as said pay-out value, said second accumulation value stored in said second memory is transferred to said first memory after paying out coins according to said particular prize or hit, and said initial value is set in said second memory.

10. An apparatus as claimed in any one of the preceding claims, wherein said controlling apparatus and said game machines form a looped communication circuit in which said game machines are connected in series and both end game machines of said series-connected game machines are connected to said controlling apparatus, whereby said controlling apparatus receives a message containing data of said insertion value of coins inserted into each said game machines for each said game, and whereby when said particular prize or hit is made in a said game machine, said controlling apparatus orders said game machine to perform pay-out for said particular prize or hit.

FIG. 1

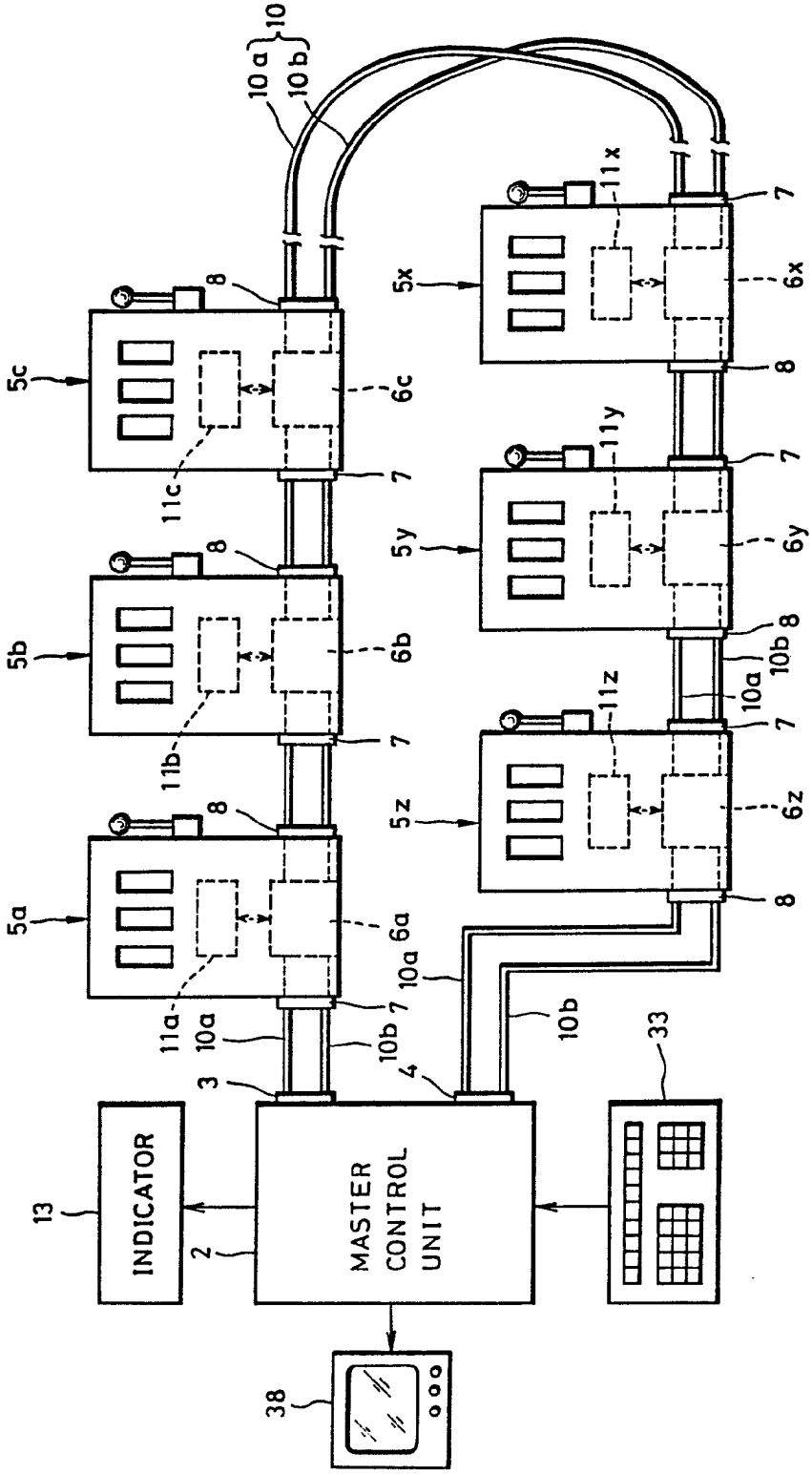

10
10a
10b
5a
5b
5c
5x
5y
5z
6a
6b
6c
6x
6y
6z
7
8
11a
11b
11c
11x
11y
11z
3
4
2
13
38
33
INDICATOR
MASTER CONTROL UNIT

FIG. 2

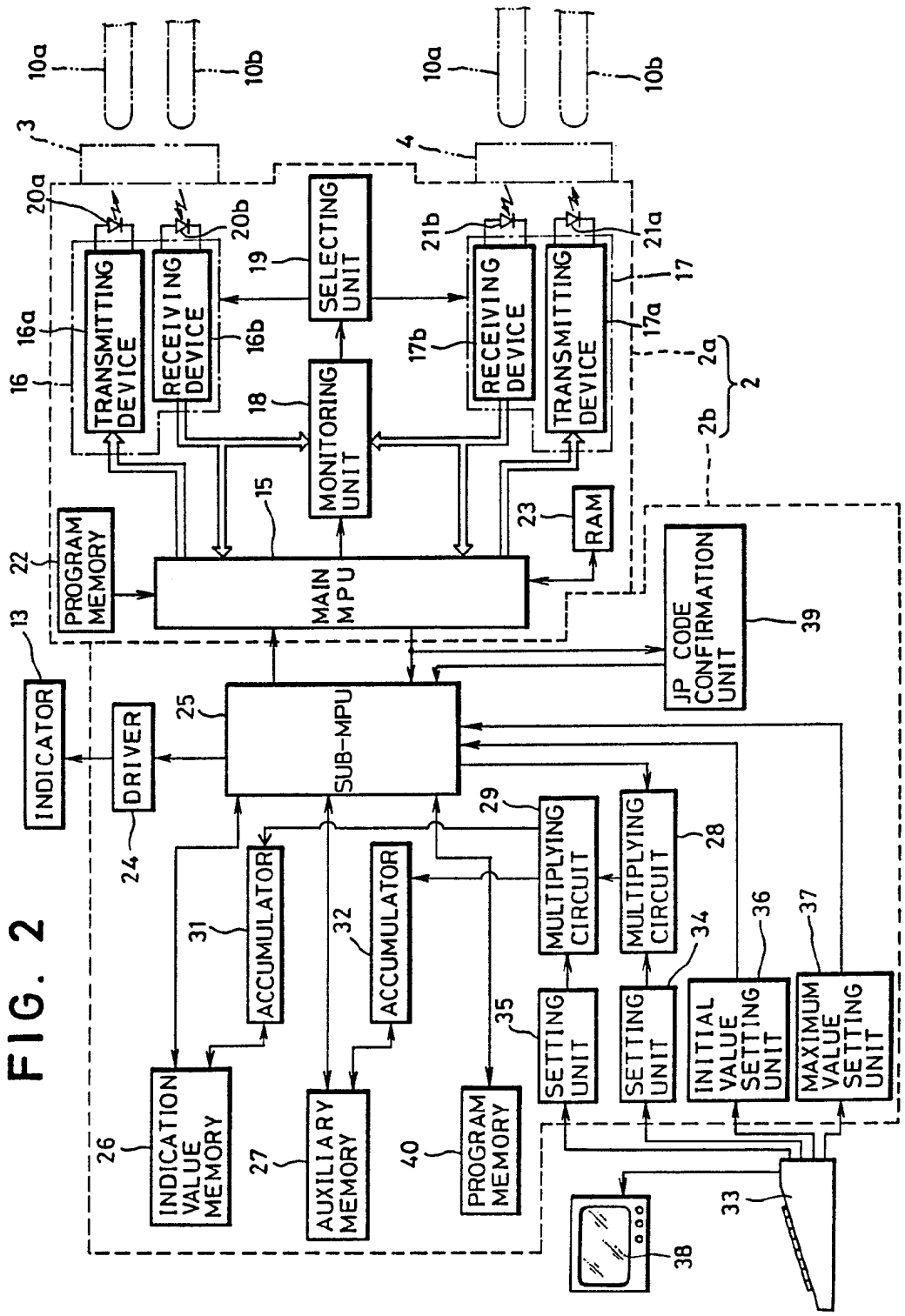

10a
10b
3
4
20a
20b
21b
21a
TRANSMITTING DEVICE
RECEIVING DEVICE
SELECTING UNIT
RECEIVING DEVICE
TRANSMITTING DEVICE
16
16a
16b
17
17a
17b
18
19
2
2a
2b
MONITORING UNIT
PROGRAM MEMORY
22
15
MAIN MPU
23
RAM
JP CODE CONFIRMATION UNIT
39
13
INDICATOR
DRIVER
24
25
SUB-MPU
29
MULTIPLYING CIRCUIT
MULTIPLYING CIRCUIT
28
31
ACCUMULATOR
32
ACCUMULATOR
35
SETTING UNIT
SETTING UNIT
34
INITIAL VALUE SETTING UNIT
36
MAXIMUM VALUE SETTING UNIT
37
26
INDICATION VALUE MEMORY
27
AUXILIARY MEMORY
40
PROGRAM MEMORY
38
33

FIG. 3

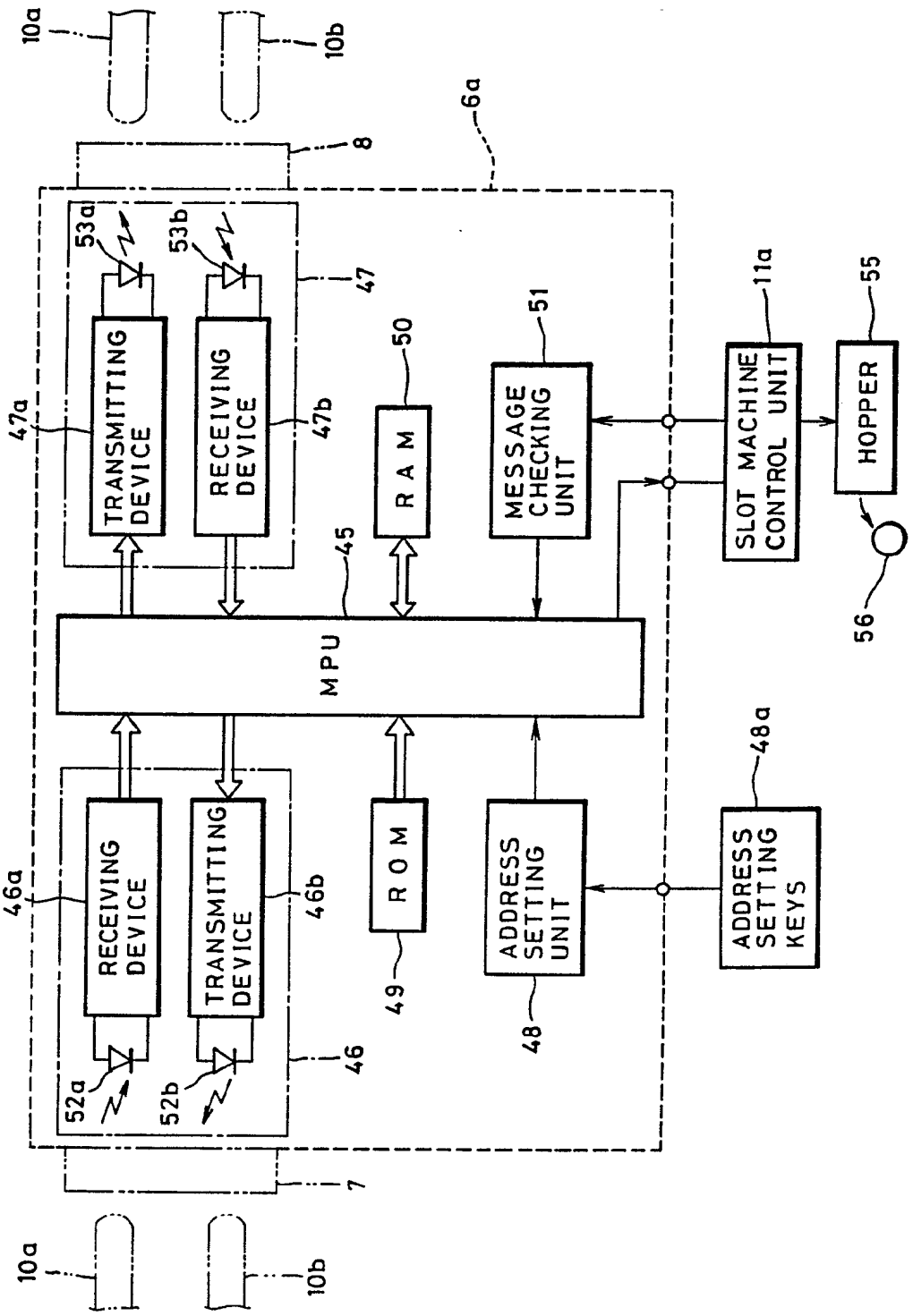

10a
10b
8
6a
53a
53b
47
TRANSMITTING DEVICE
RECEIVING DEVICE
47a
47b
50
R A M
51
MESSAGE CHECKING UNIT
11a
SLOT MACHINE CONTROL UNIT
55
HOPPER
56
45
MPU
46a
RECEIVING DEVICE
TRANSMITTING DEVICE
46b
R O M
49
ADDRESS SETTING UNIT
48
48a
ADDRESS SETTING KEYS
52a
52b
46
7
10a
10b

FIG. 4

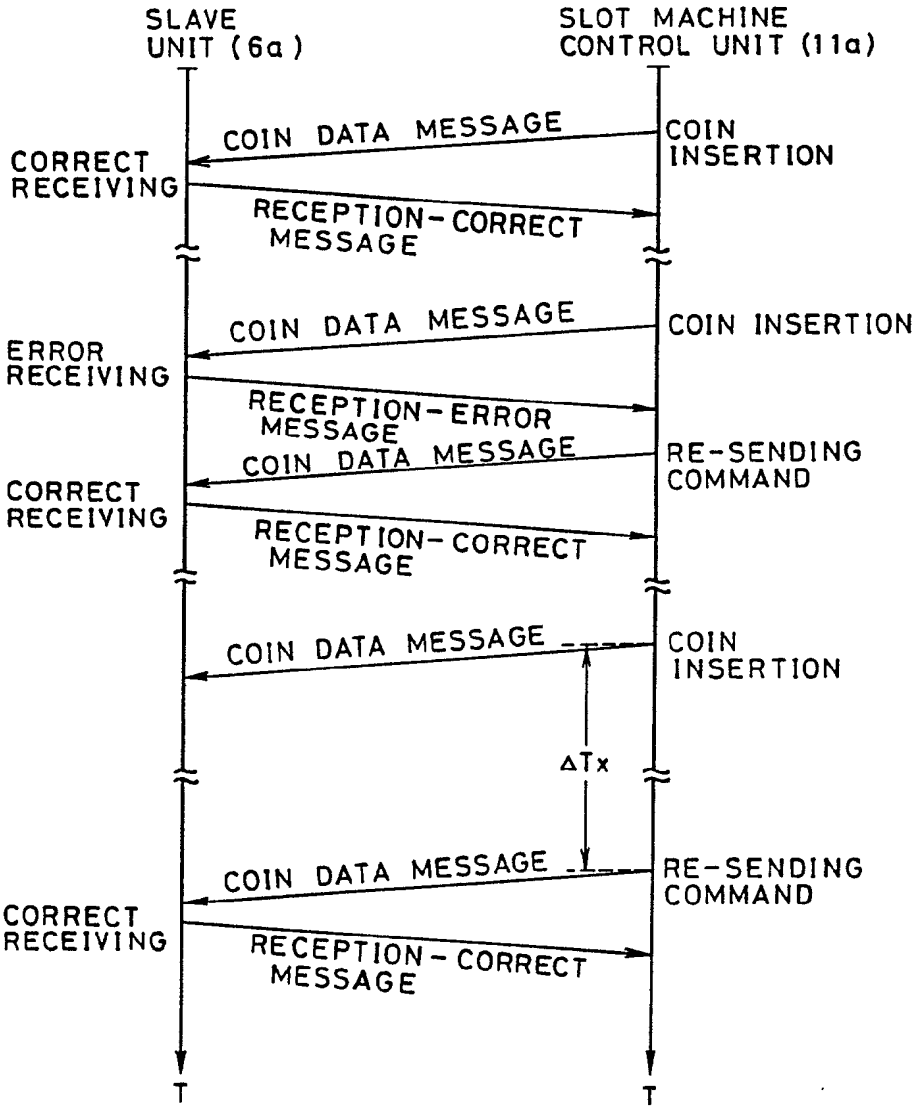

SLAVE UNIT (6a)
SLOT MACHINE CONTROL UNIT (11a)
COIN DATA MESSAGE
COIN INSERTION
CORRECT RECEIVING
RECEPTION-CORRECT MESSAGE
COIN DATA MESSAGE
COIN INSERTION
ERROR RECEIVING
RECEPTION-ERROR MESSAGE
COIN DATA MESSAGE
RE-SENDING COMMAND
CORRECT RECEIVING
RECEPTION-CORRECT MESSAGE
COIN DATA MESSAGE
COIN INSERTION
ΔTx
COIN DATA MESSAGE
RE-SENDING COMMAND
CORRECT RECEIVING
RECEPTION-CORRECT MESSAGE
T
T

FIG. 5

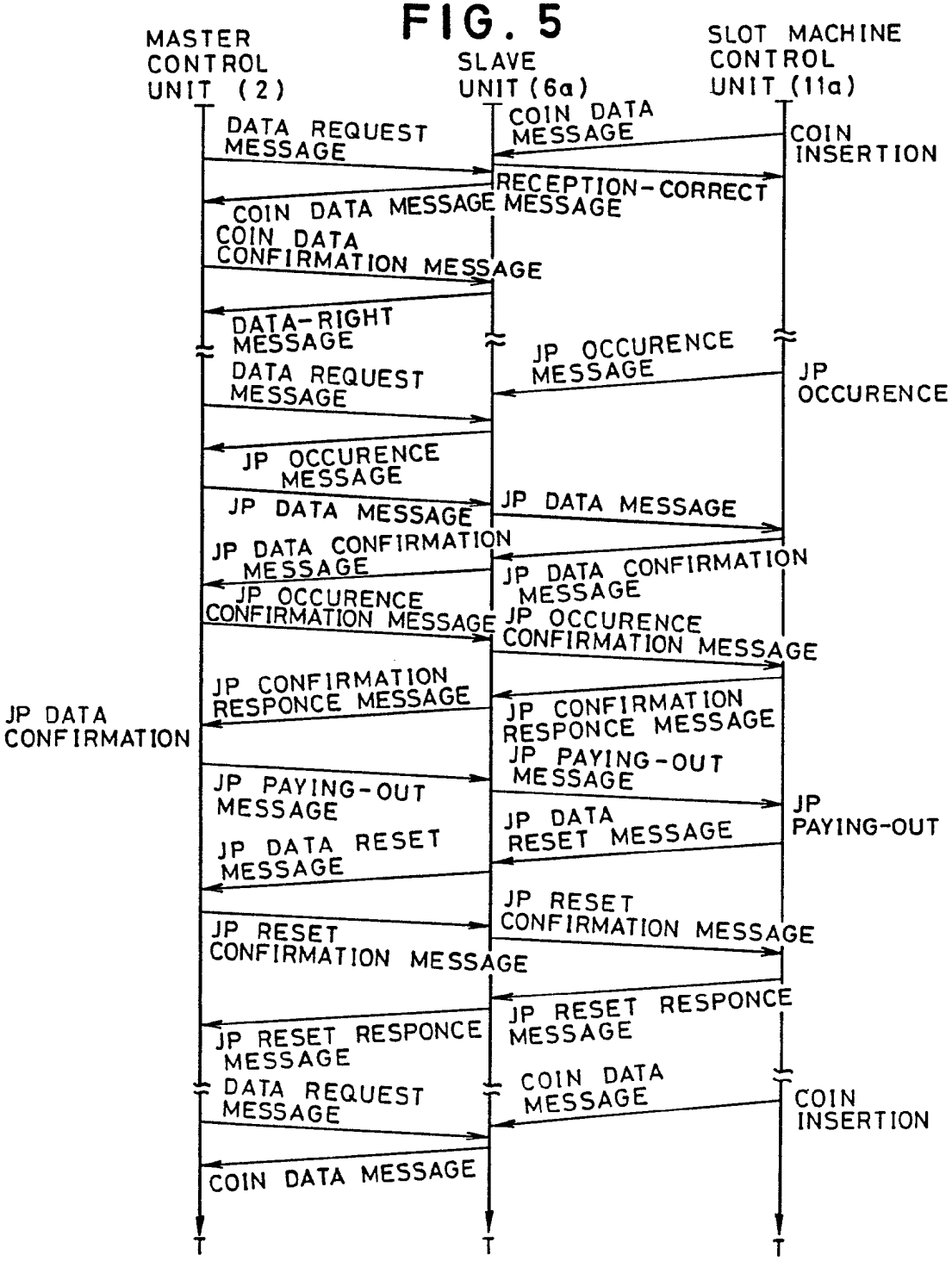

MASTER CONTROL UNIT (2)
SLAVE UNIT (6a)
SLOT MACHINE CONTROL UNIT (11a)
DATA REQUEST MESSAGE
COIN DATA MESSAGE
COIN INSERTION
RECEPTION-CORRECT MESSAGE
COIN DATA MESSAGE
COIN DATA CONFIRMATION MESSAGE
DATA-RIGHT MESSAGE
JP OCCURENCE MESSAGE
DATA REQUEST MESSAGE
JP OCCURENCE
JP OCCURENCE MESSAGE
JP DATA MESSAGE
JP DATA MESSAGE
JP DATA CONFIRMATION MESSAGE
JP DATA CONFIRMATION MESSAGE
JP OCCURENCE CONFIRMATION MESSAGE
JP OCCURENCE CONFIRMATION MESSAGE
JP CONFIRMATION RESPONCE MESSAGE
JP CONFIRMATION RESPONCE MESSAGE
JP DATA CONFIRMATION
JP PAYING-OUT MESSAGE
JP PAYING-OUT MESSAGE
JP DATA RESET MESSAGE
JP
PAYING-OUT
JP DATA RESET MESSAGE
JP RESET CONFIRMATION MESSAGE
JP RESET CONFIRMATION MESSAGE
JP RESET RESPONCE MESSAGE
JP RESET RESPONCE MESSAGE
DATA REQUEST MESSAGE
COIN DATA MESSAGE
COIN INSERTION
COIN DATA MESSAGE

FIG. 6

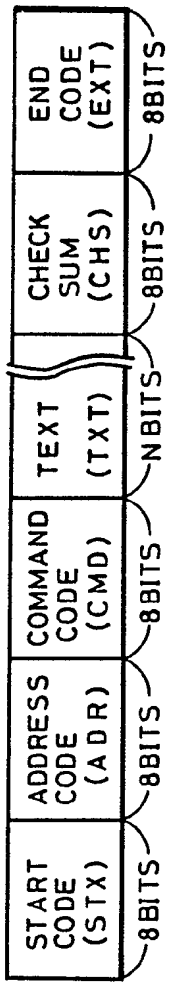


FIG. 7

	0	1	2	3	4	5
0			DATA REQUEST	COIN DATA		
1			JP DATA	JP OCCURENCE		
2	S T X		JP DATA CONFIRMATION	JP DATA		
3	E T X		JP RESPONCE	JP RESPONCE		
4				JP RESET		
5				RESET RESPONCE		

FIG. 8

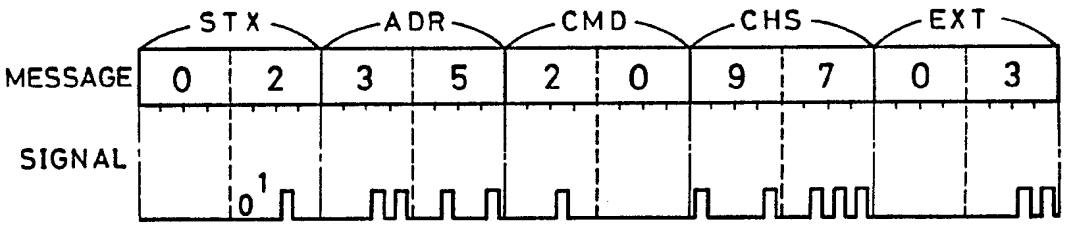


FIG. 9

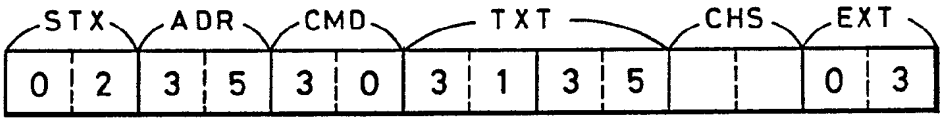


FIG. 11

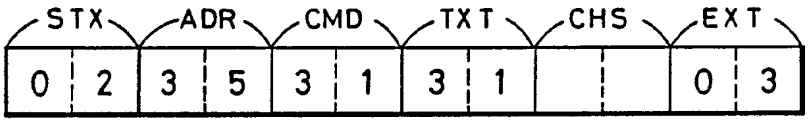


FIG. 12

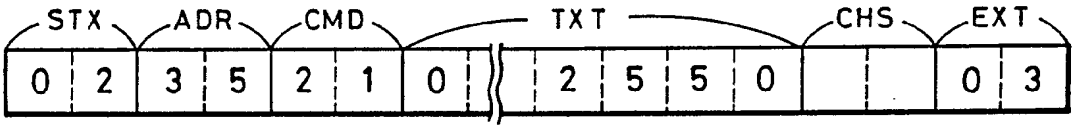
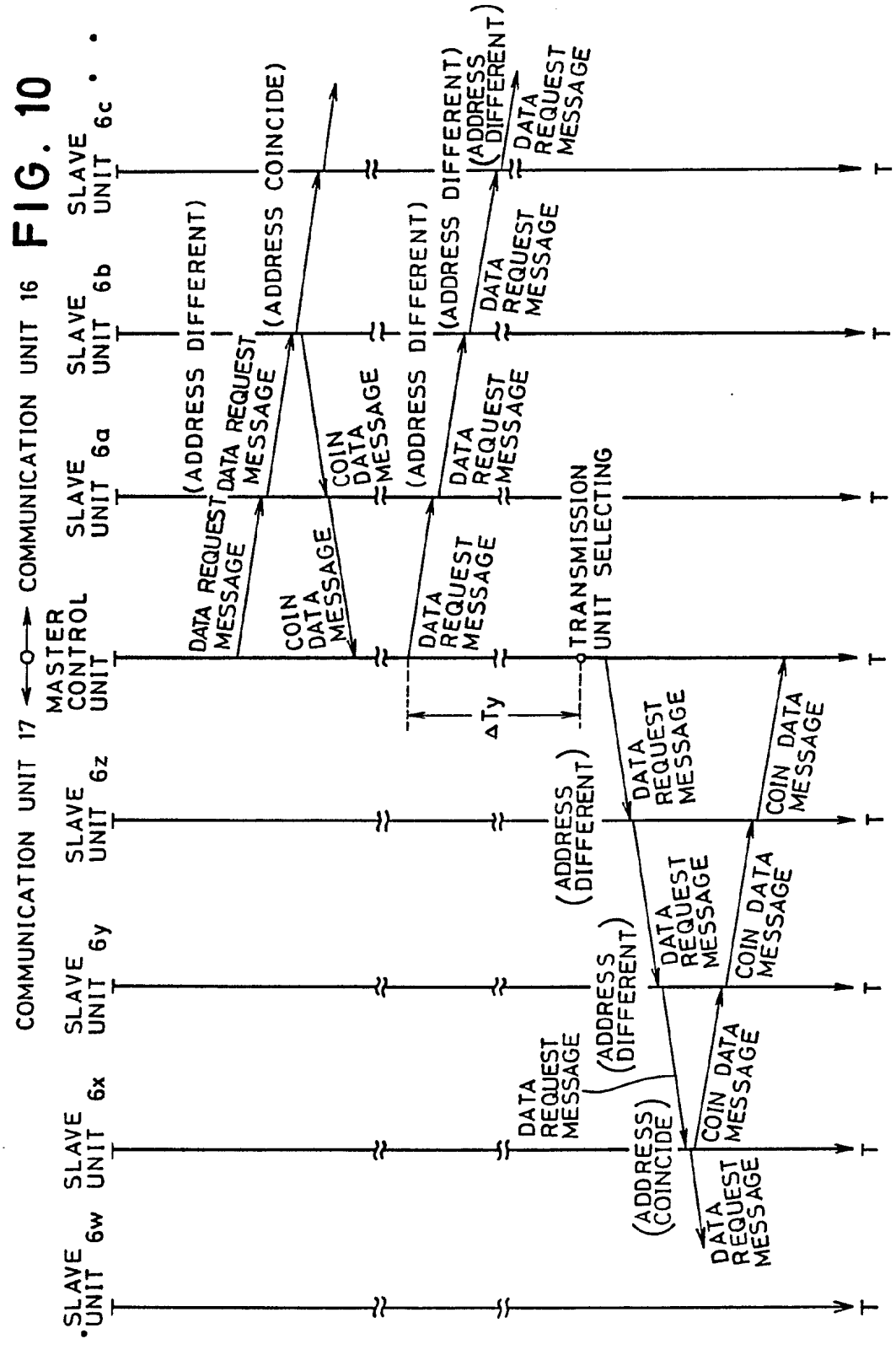


FIG. 10


COMMUNICATION UNIT 17
MASTER CONTROL UNIT
COMMUNICATION UNIT 16
SLAVE UNIT 6a
SLAVE UNIT 6b
SLAVE UNIT 6c
SLAVE UNIT 6w
SLAVE UNIT 6x
SLAVE UNIT 6y
SLAVE UNIT 6z
DATA REQUEST MESSAGE
COIN DATA MESSAGE
(ADDRESS DIFFERENT)
(ADDRESS COINCIDE)
TRANSMISSION UNIT SELECTING
ΔTy